

# Patent [19]

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## [54] **METHOD FOR PRODUCING AN IMPROVED LAYER, PARTICULAR FOR A DRILL BIT**

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## [57] **ABSTRACT**

Process for producing an article, e.g. a drill bit, wherein a first layer (4) of powder material is applied to a core member (3) by cold isostatic compacting and subsequent sintering, and a second, exterior layer (5) is then applied by thermal spraying followed by hot isostatic compacting. The powder material of the first layer (4) may be a nickel-containing alloy steel powder.

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### Description

The invention relates to a method for producing a solid core-member on which an exterior layer is applied by thermal spraying, followed by hot isostatic compaction.

Such a method is disclosed in British Patent 1,367,762 In application of the method described above to objects wherein it is required that the exterior layer applied be capable, in operation of withstanding great variable forces, for example, that it must be resistant to wear, however, it happens that this layer subjected to erosive circumstances often chips off, thus shortening the life of the object obtained.

The invention accordingly procures a method of the type mentioned at the beginning, which improves the service of objects subjected thereto and is characterized in that on said member a layer of powder material is applied by cold iso- static compaction, followed by sintering, where- after an exterior layer, which is a wear- resistant layer, is applied by plasma spraying and where- after the said structure

obtained is isostatically hot compacted.

It has been found that a suitable powder material for this purpose is a nickel-containing alloy steel powder with preferably 3.5 % nickel therein.

For the performance of a method pursuant to the invention a supply of powder material is introduced into a rubber mold and distributed, after which the core-member, which is usually a type of steel suitable for a bearing, is placed in the powder, following which the powder is pressed on. The core-member may alternatively be placed in the mold first, after which the powder material is introduced and pressed on. The mold is closed and is then isostatically compacted cold until a coherent member having a density of approximately 90 % is obtained. The compact removed from the mold is then sintered in a furnace. After cooling the sintered object is coated with a wear-resistant layer by thermal spraying, for example plasma spraying, after which the structure thus obtained is isostatically compacted hot. This hot isostatic compacting may be done by inserting the entire object in a thin-walled deep-drawn vessel or container of low-carbon steel having a wall thickness of approximately 0.5 mm, filled with a ceramic powder. This vessel is then heated and placed under pressure on all sides. After hot isostatic compacting the object may be readily separated from the surrounding ceramic mass and cleaned by sand blasting. This method proves to procure components with accurately shaped dimensions comparable to those of a forged product.

When e.g. a drill bit for rock is produced in this fashion, after sintering not the entire surface of the cutting teeth but only the parts thereof which come directly into contact with the rock are coated with the wear-resistant layer by thermal spraying. Following the selective application of the wear-resistant layer the preformed drill bit is subjected in its entirety to the method as defined above. The European Patent 0005285 discloses a method for applying a wear-resistant layer on a rock drill bit accordingly to which the sprayed-on layer however is directly consolidated by hot isostatic compaction.

The invention is now explained in greater detail by means of the accompanying drawing, which represents a preferred embodiment of the invention.

Fig 1 is a cross section of a drill bit produced according to the invention.

Fig 2 is a perspective view of a portion of this drill bit.

15 The drill bit 1 shown in Fig 1 is composed of a core member 3, made of a bearing material, in which are applied the races 2 for the foiling elements (not shown). On this core member 3, solid at the beginning, is applied, in a rubber mold, a layer 4 of powder, which combination is isostatically compacted cold. This operation takes place preferably under a pressure of approximately 6000 atmospheres at room temperature. Then the preformed drill bit, isostatically compacted cold, is removed from the mold and sintered in a sintering furnace at a temperature of approximately 12000 °C at 1 atmosphere under reduction by hydrogen for approx 1 hour, which operations lead to a density of approx 90 % of the compacted material. Then, by means of plasma spraying technique, the wear-resistant layer 5 is applied on the layer 4 and the object obtained is then inserted into a vessel or container and isostatically compacted hot under a pressure of for example 1600 atmospheres and at a temperature of approx 11000 °C for at least 2 hours. This operation results in a density of the layers 4 and 5 of 99 % and a very solid bond between the layers.

It will be found by the method pursuant to the invention that the mechanical properties of the drill bit thus formed are greatly improved, like the bond between layers 4 and 5, on the one hand, and the layer 4 and the core member 3, on the other. By this means the desired effect of very high resistance to

wear and resistance to chipping of the cutting teeth is obtained, combined with a core member which functionally has other possible applications, such as, for example, the function of a bearing.

It is noted that the original solid core member 3, after mechanical operations and heat treatment, acquires the shape, as represented in Fig 1, in which the races 2 of the rolling elements are supplied.

It may be seen further from Fig 2 that not the entire surface of the cutting teeth of the drill bit is provided with the wear-resistant layer 5, but that the wear-resistant layer is applied only on the places where the tooth comes directly into contact with rock during operation.

Thus there is procured by the invention a device, such as a drill bit, which in principle consists of three parts, namely, a significantly improved cutting part 5, a supporting part 4 and a core or bearing part 3, which parts are combined in an economically and technically advantageous manner such that the said drill bit satisfies the requirements set.

## Claims

1 Method for producing a solid core-member on which an exterior layer is applied by thermal spraying, followed by hot isostatic compaction characterized in that on said member ( 3 ) a layer ( 4 ) of a powder material is applied by cold isostatic compaction, followed by sintering, whereafter an exterior layer ( 5 ), which is a wear-resistant layer, is applied by plasma spraying and whereafter the said structure obtained is isostatically hot compacted.

2 Method according to claim 1, characterized in that the core-member ( 3 ) forms a hollow piece made of a bearing material which is capable of receiving rolling bearing elements.

3 Method according to claim 1 or 2, characterized in that the powder material of said first layer ( 4 ) is a nickel-containing alloy steel powder.

4 Method according to claim 3, characterized in that the steel powder contains 3 to 5 % nickel.

Method according to claims 1-4, characterized in that, after sintering the wear-resistant layer ( 5 ) is only sprayed on surface parts of said first layer ( 4 ) which in operation are directly subjected to wearing circumstances.

Patentansprüche 1 Verfahren zum Herstellen eines Massivkern-Bauteils, an welchem eine äußere

Schicht durch Warmespritzen, gefolgt von heiler isostatischer Verdichtung, angebracht wird, dadurch gekenn- zeichnet, dalr an dem Bauteil ( 3) ein Schicht ( 4) eines Pulvermaterials durch kalte isostatische Ver- dichtung, gefolgt von einer Sinterung, angebracht wird, woraufhin die a Oluere Schicht ( 5), die eine verschleilifeste Schicht ist, durch Plasmaspritzen angebracht wird, und woraufhin das dadurch erhaltene Gebilde isostatisch heiliverdichtet wird.

2 Verfahren nach Anspruch 1, dadurch gekenn- zeichnet, da 13 das Kern-Bauteil ( 3) ein aus einem Lagermaterial gefertigtes Hohlteil bildet, das in der Lage ist, Walzk 6 rper aufzunehmen.

3 Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, dal das Pulvermaterial der er- sten Schicht ( 4) ein Nickel enthaltendes Sonder- stahlpulver ist.

4 Verfahren nach Anspruch 3, dadurch gekenn- zeichnet, dalr das Stahlpulver 3,5 % Nickel enthalt.

Verfahren nach Ansprüchen 1-4, dadurch gekennzeichnet, da 13 nach der Sinterung die verschleilifeste Schicht ( 5) nur auf diejenigen Oberflachenteile der ersten Schicht ( 4) gespritzt wird, die im Betrieb unmittelbar Abnuitzungen unterworfen sind.

Revendications 1 Proc 6 d 6 de fabrication d'un 6 lement central resistant, sur lequel une couche ext 6 rieur est appliquee par pulverisation a chaud, suivie d'une compression isostatique a chaud, caracterise en ce que, sur l'616 ment ( 3), une couche ( 4) de matibre en poudre est appliquee par compression isostatique a froid, suivie d'un frittage, apres quoi une couche exterieure ( 5), qui est une couche resistente a l'usure, est appliquee par projection de plasma et apr 6 S quoi la structure obtenue est comprim 6 e isostatiquement a chaud.

2 Procede selon la revendication 1, caracterise en ce que l'e 16 ment central ( 3) forme une piece creuse en matiere antifricition capable de recevoir des elements de roulements roulants.

3 Proc 6 de selon la revendication 1, ou 2, caract 6 ris 6 en ce que la matiere en poudre de la premiere couche 4 est une poudre d'acier allie contenant du nickel.

4 Procede selon la revendication 3, caract 6 ris 6 en ce que la poudre d'acier contient 3,5 % de nickel.

Procédé selon les revendications 1 à 4, caractérisé en ce que, après le frittage, la couche (5) résistante à l'usure est projetée uniquement sur des parties de la surface de la première couche (4) qui, en fonctionnement, sont directement soumises à des conditions d'usure.

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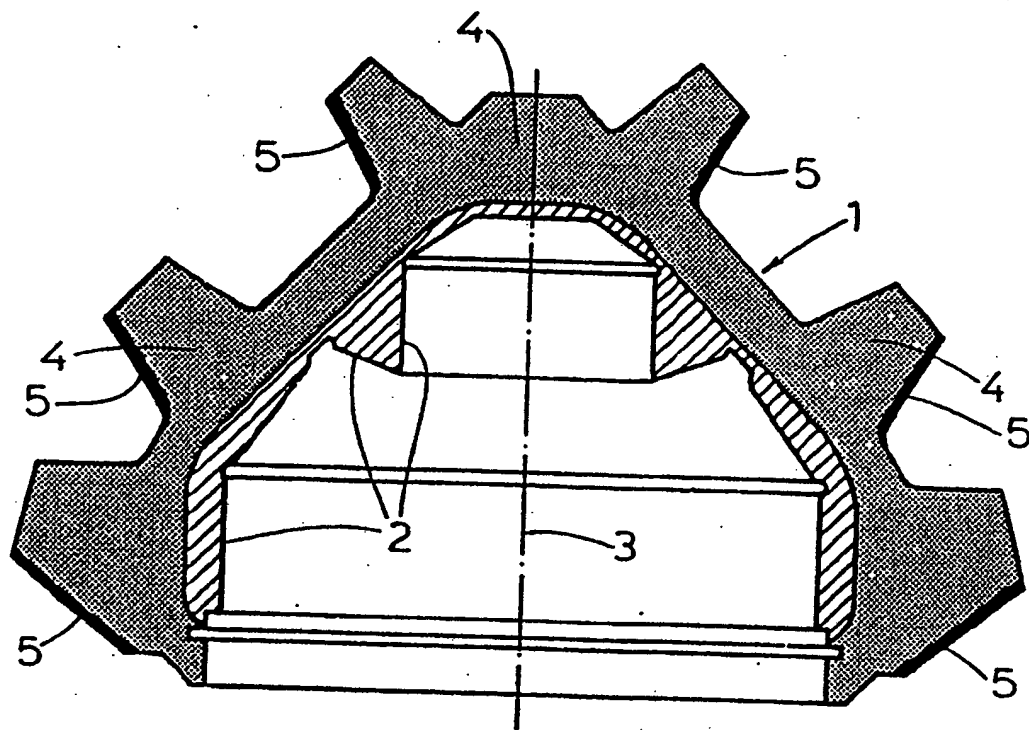


fig.1

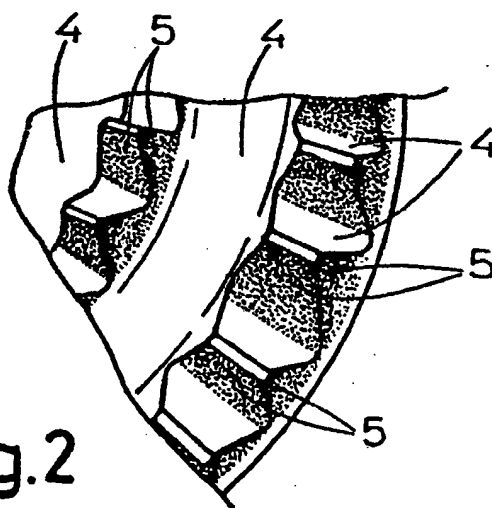


fig.2